National Aeronautics and Space Administration

Goddard View

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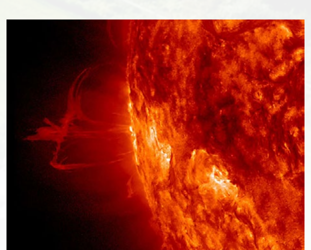
GoddardView

TRENDING

Algae Bloom on Lake Erie
Algae blooms are a regular occurrence on Lake Erie in summer. The microscopic, floating plants flourish in June and July as the water warms. It's not every year that a bloom leads to the shutdown of water supplies in an American city. Click on the image to see more.

Melt Ponds Shine in Laser Altimeter Flight Images
On July 16 and July 17, NASA's ER-2 aircraft flew above Alaskan glaciers and to the North Pole, carrying MABEL, a laser altimeter, measuring the elevation of glaciers, mountains, forests and other topography below. Learn more by clicking on the photo.

Conversations with Goddard
Thermal engineer Christine Cottingham thinks it's cool to work on Goddard's thermally hottest program. Read more about Cottingham and other Conversations with Goddard by clicking on the image.



Spritely Prominence
A thin solar prominence appeared above the Sun, then sprouted numerous streams of plasma back into the Sun before disappearing a day later (July 28-29, 2014). Forces associated with strong magnetic fields beneath the prominence are controlling the prominence and its streams. Click the image for more.

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On the cover: Goddard Center Director Chris Scolese speaks to gathered media at Goddard's Visior Center. NASA Administratr Charles Bolden is in the background. Photo credit: NASA/Goddard/Bill Hrybyk

GoddardView Info

Goddard View is an official publication of NASA's Goddard Space Flight Center. Goddard View showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover and understand our dynamic universe. Goddard View is published by NASA Goddard's Office of Communications.

You may submit contributions to the editor at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

CONTENTS

NASA GETS AN 'A' IN SMALL BUSINESS CONTRACTING

By: Izumi Hansen

The Small Business Administration gave NASA an "A" for awarding 22 percent of its federal contracts to small businesses in 2013—5 percent higher than targeted.

On Aug. 1, NASA Administrator Charles Bolden joined Small Business Administrator Maria Contreras-Sweet and U.S. Sen. Ben Cardin of Maryland at NASA's Goddard Space Flight Center's Visitor Center in Greenbelt, Maryland to announce the results of the 2013 Small Business Federal Procurement Scorecard.

"At NASA, we're in the business of shooting for the stars and learning along the way how we can get better," Bolden said. "We also take our commitment to small business very seriously."

The annual scorecard measures federal agencies' inclusion of small business in federal contracts by the agency's progress to reach small business inclusion goals.

"When we hit our small business procurement project it's a win-win-win," said Contreras-Sweet. "NASA's mission may be galaxies away, but are creating jobs right here at home."

About 400 small businesses support Goddard in institutional maintenance, engineering design and technology support.

Edge Space System of Maryland is one of those small businesses. Edge Space System is currently working on five contracts and develops thermal engineering designs for many NASA projects including the James Webb Space Telescope and Global Precipitation Measurement mission.

The Scorecard considers overall involvement of small businesses as well as specific goals concerning small businesses in areas designated to be historically underutilized, small businesses with socially or economically disadvantaged owners, and small businesses owned by women or service-disabled veterans.

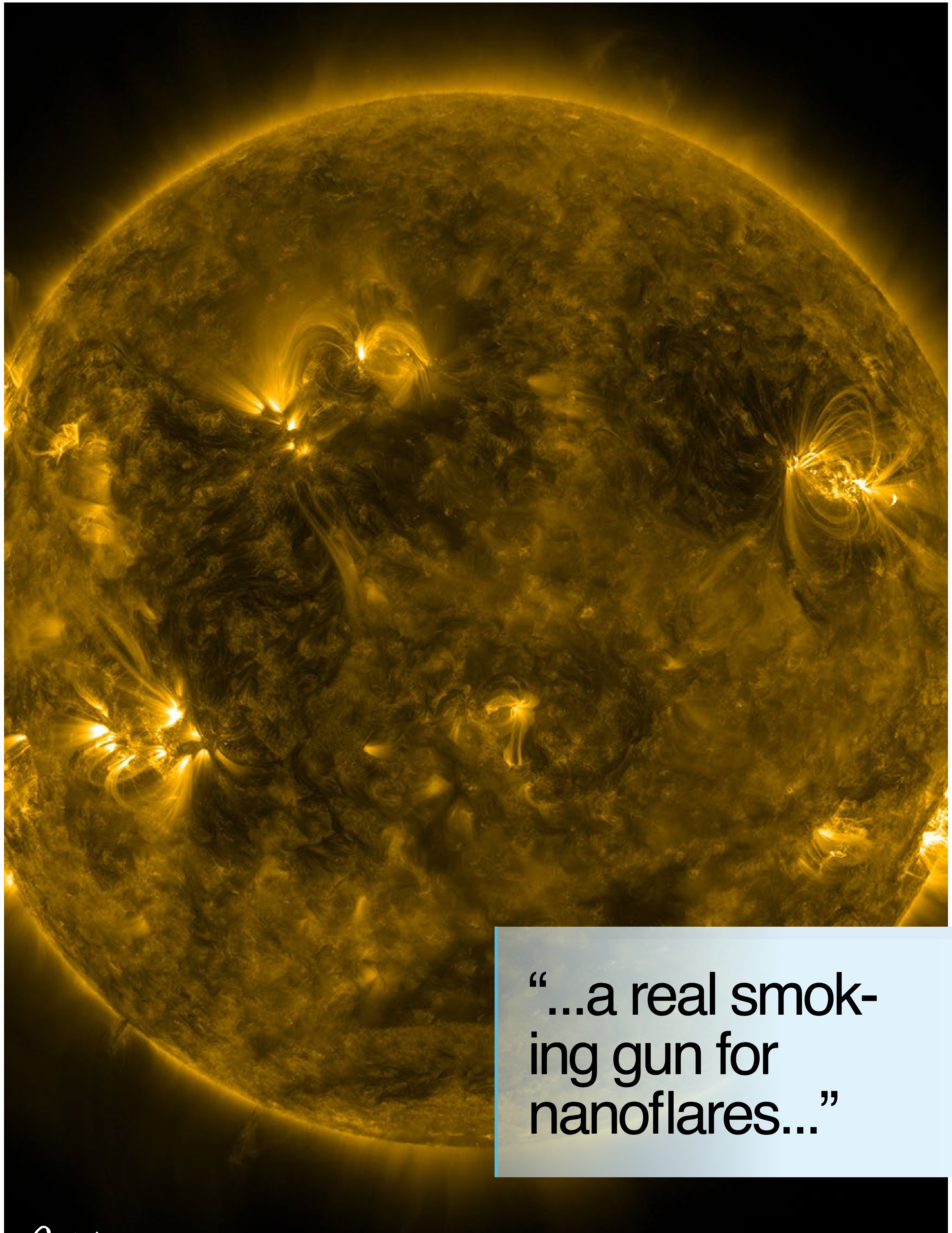
Agencies and the Small Business Administration decide goals every two years to determine each agency's progress. The SBA ensures the sum of all goals accounts for 23 percent of the federal workforce.

"Innovation comes from the smaller companies," said Cardin, who is a member of the Senate Finance Committee and Senate Committee for Small Business and Entrepreneurship. "[NASA] contracts with small business because it helps create the mission."

Goddard Center Director Chris Scolese, Greenbelt Mayor Emmett Jordan, Edge Space Systems owner and President Cindy Edgerton and members of the media attended the meeting.

Following the media presentation, Bolden, Contreras-Sweet and Cardin met to discuss small business. ■

Above from left: NASA Goddard Center Director Chris Scolese, Edge Space Systems founder and President Cindy Edgerton, Small Business Administrator Maria Contreras-Sweet (at podium), NASA Administrator Charles Bolden and U.S. Sen. Ben Cardin of Maryland, at Goddard's visitor center on Aug. 1, 2014. Photo credit: NASA/Goddard/Bill Hrybyk



“...a real smoking gun for nanoflares...”

NASA SOUNDING ROCKET DETECTS BEST EVIDENCE YET FOR CORONAL HEATING THEORY

By: Karen C. Fox

Scientists have recently gathered some of the strongest evidence to date to explain what makes the sun’s outer atmosphere so much hotter than its surface. The new observations of the small-scale, extremely hot temperatures are consistent with only one current theory: something called nanoflares—a constant peppering of impulsive bursts of heating, none of which can be individually detected—provide the mysterious extra heat.

What’s even more surprising is these new observations come from just six minutes worth of data from one of NASA’s least expensive type of missions, a sounding rocket. The EUNIS mission, short for Extreme Ultraviolet Normal Incidence Spectrograph, launched on April 23, 2013, obtaining a snapshot of data every 1.3 seconds to track the properties of material over a wide range of temperatures in the complex solar atmosphere.

The sun’s visible surface, called the photosphere, is some 6,000 Kelvins, while the corona regularly reaches temperatures that are 300 times as hot.

“That’s a bit of a puzzle,” said Jeff Brosius, a space scientist at Catholic University in Washington, D.C., and NASA’s Goddard Space Flight Center in Greenbelt, Maryland. “Things usually get cooler farther away from a hot source. When you’re roasting a marshmallow you move it closer to the fire to cook it, not farther away.”

Several theories exist for how the magnetic energy coursing through the corona is converted into the heat that raises the temperature. Different theories make different predictions about what kind of—and what temperature—material might be observable, but few observations have high enough resolution over a large enough area to distinguish between these predictions.

NASA equipped the EUNIS rocket with a spectrograph to gather information about how much material is present at a given temperature, by recording different wavelengths of light. To observe the extreme ultraviolet wavelengths necessary to distinguish between various coronal heating theories, a spectrograph can only work properly in space above the atmosphere surrounding Earth that blocks ultraviolet light. So EUNIS flew up nearly 200 miles above the ground and gathered about six minutes worth of observations.

The EUNIS spectrograph was tuned to a range of wavelengths useful for spotting material at temperatures of 10 million Kelvin, which are a signature of nanoflares. Scientists have hypothesized that a myriad of nanoflares could heat up solar material in the atmosphere to temperatures of up to 10 million Kelvins. This material would cool very rapidly, producing ample solar material at the 1 to 3 million degrees regularly seen in the corona.

Looking over the EUNIS data, the team spotted a wavelength of light corresponding to that 10 million degree material.

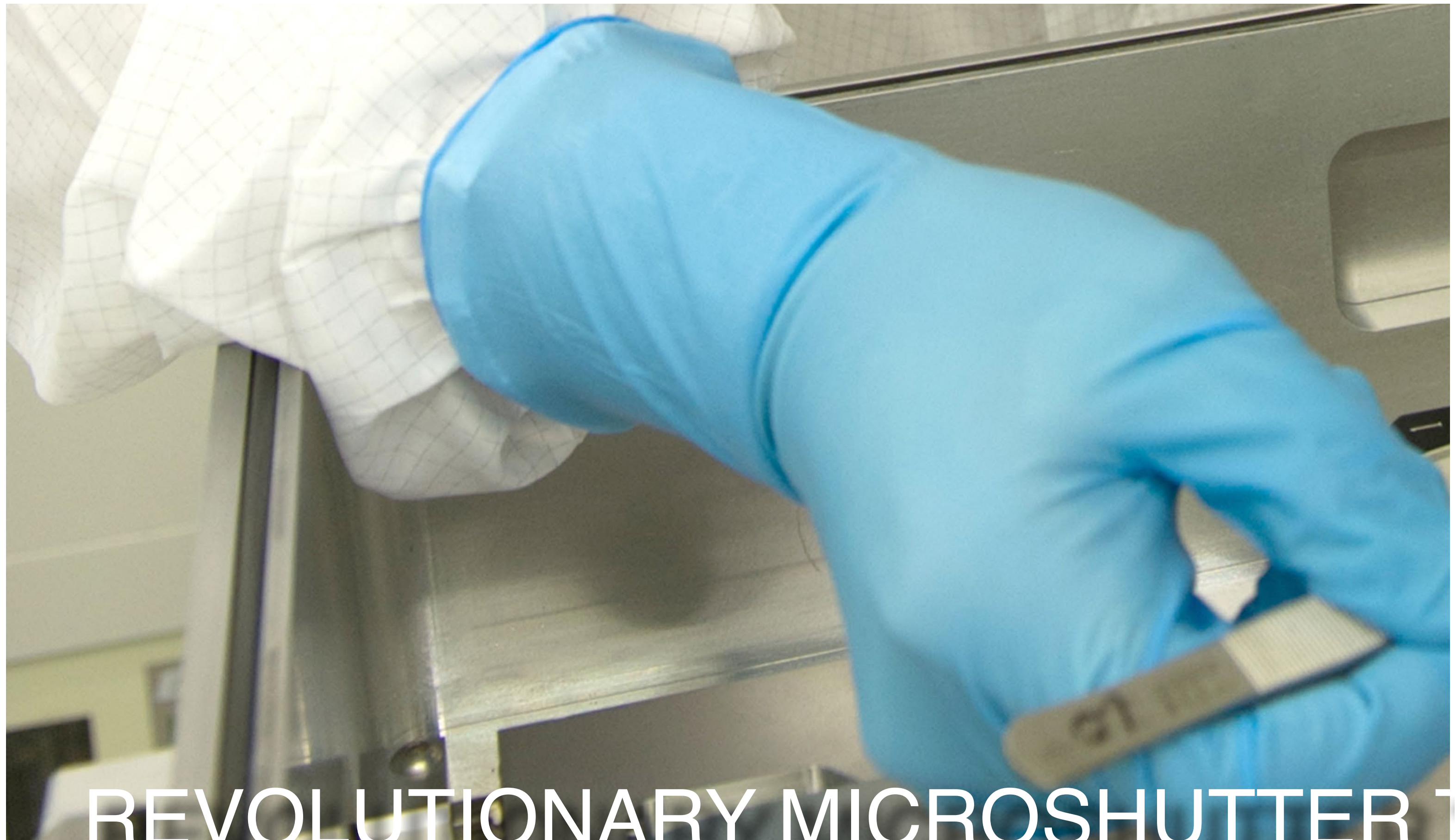
“This weak line observed over such a large fraction of an active region really gives us the strongest evidence yet for the presence of nanoflares,” said Brosius.

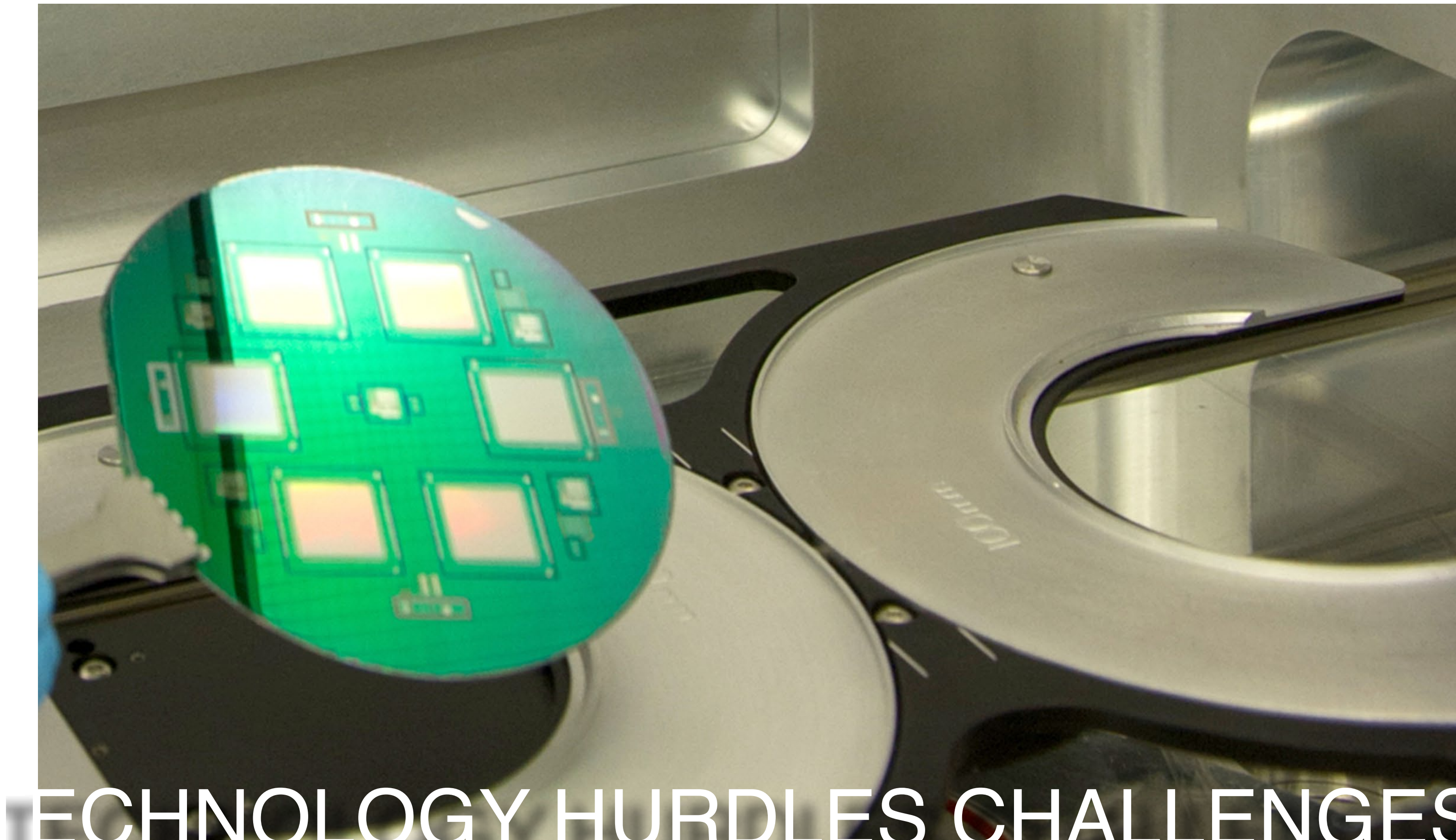
Scientists will continue to explore various theories further, gathering additional observations as their tools and instruments improve. However, no other theory predicts material of this temperature in the corona, so this is a strong piece of evidence in favor of the nanoflare theory.

“This is a real smoking gun for nanoflares,” said Adrian Daw, the current principal investigator for EUNIS at Goddard. “And it shows that these smaller, less expensive sounding rockets can produce truly robust science.”

In addition to having a lower cost, sounding rockets offer a valuable test bed for new technology that may subsequently be flown on longer-term space missions and the instruments parachute back to the ground so they can be recovered and re-used. The EUNIS mission will be re-tuned to focus on a different set of solar wavelengths—ones that can also spot the extremely high temperature material representative of nanoflares and fly again sometime in 2016. ■

Opposite: Caption: NASA’s Solar Dynamic Observatory captured this image of what the sun looked like on April 23, 2013, at 1:30 p.m. EDT when the EUNIS mission launched. EUNIS focused on an active region of the sun, seen as bright loops in the upper right in this picture. Image credit: NASA/SDO





REVOLUTIONARY MICROSHUTTER TECHNOLOGY HURDLES CHALLENGES

By: Lori J. Keesey

NASA technologists have hurdled a number of significant technological challenges in their quest to improve an already revolutionary observing technology originally created for the James Webb Space Telescope.

The team, led by Goddard scientist Harvey Moseley, has demonstrated that electrostatically actuated microshutter arrays—that is, those activated by applying a specific voltage—are as functional as the current technology's magnetically activated arrays. This advance makes them a highly attractive capability for potential Explorer-class missions designed to perform multi-object observations.

"We have identified real applications—three scientists want to use our microshutter arrays and the commercial sector has expressed interest," said Mary Li, a Goddard engineer who is working with Moseley and other team members to develop this already groundbreaking observing technology. "The electrostatic concept has been fully demonstrated and our focus now is on making these devices highly reliable."

Progress, she said, is due to the successful elimination of all macro-moving parts—in particular, a large magnet. The team also dramatically lowered the voltage needed to actuate the microshutter array and applied advanced electronic circuitry and manufacturing techniques to assure the microshutter arrays' dependable operation in orbit, Li added.

Considered among the most innovative technologies to fly on the Webb telescope, the microshutter assembly is created from micro-electro-mechanical technologies and comprises thousands of tiny shutters, each about the width of a human hair.

Assembled on four postage-size grids or arrays, the 250,000 shutters open or close individually to allow only the light from targeted objects to enter Webb's Near Infrared Spectrograph (NIRSpec), which will help identify types of stars and gases and measure their distances and motions. Because Webb will observe faint, far-away objects, it will take as long as a week for NIRSpec to gather enough light to obtain good spectra.

NIRSpec's microshutter array, however, enhances the instrument's observing efficiencies. It will allow scientists to gather spectral data on 100 objects at a time, vastly increasing the observatory's productivity. When NASA launches the Webb telescope in 2018, it will represent a first for multi-object spectroscopy.

Determined to make the microshutter technology more broadly available, Goddard technologists have spent the past four years experimenting with techniques to advance this capability.

One of the first things the team did was eliminate the magnet that sweeps over the shutter arrays to activate them. As with all mechanical parts, the magnet takes up space, adds weight, and is prone to mechanical failure. Perhaps more important, the magnet cannot be easily scaled up in size. As a result, the instrument's field of view—that is, the area that is observable through an instrument—is limited in size. This impedes next-generation space observatories that will require larger fields of view, she said.

With the new approach, an alternating-current voltage is applied to electrodes placed on the frontside of the microshutters, causing them to swing open. To latch the desired shutters, a direct current voltage is applied to electrodes on the backside. In other words, only the needed shutters are opened; the rest remain closed.

Just as significant is the voltage needed to actuate the arrays. When the effort first began four years ago, the team only could open and close the shutters with 1,000 volts. By 2011, the team had slashed that number to 80 volts—a level that still could exceed instrument voltage specifications. By last year, the team had achieved a major milestone by activating the shutters with just 30 volts—a voltage sweet spot, Li said.

"But we also did something else," she added.

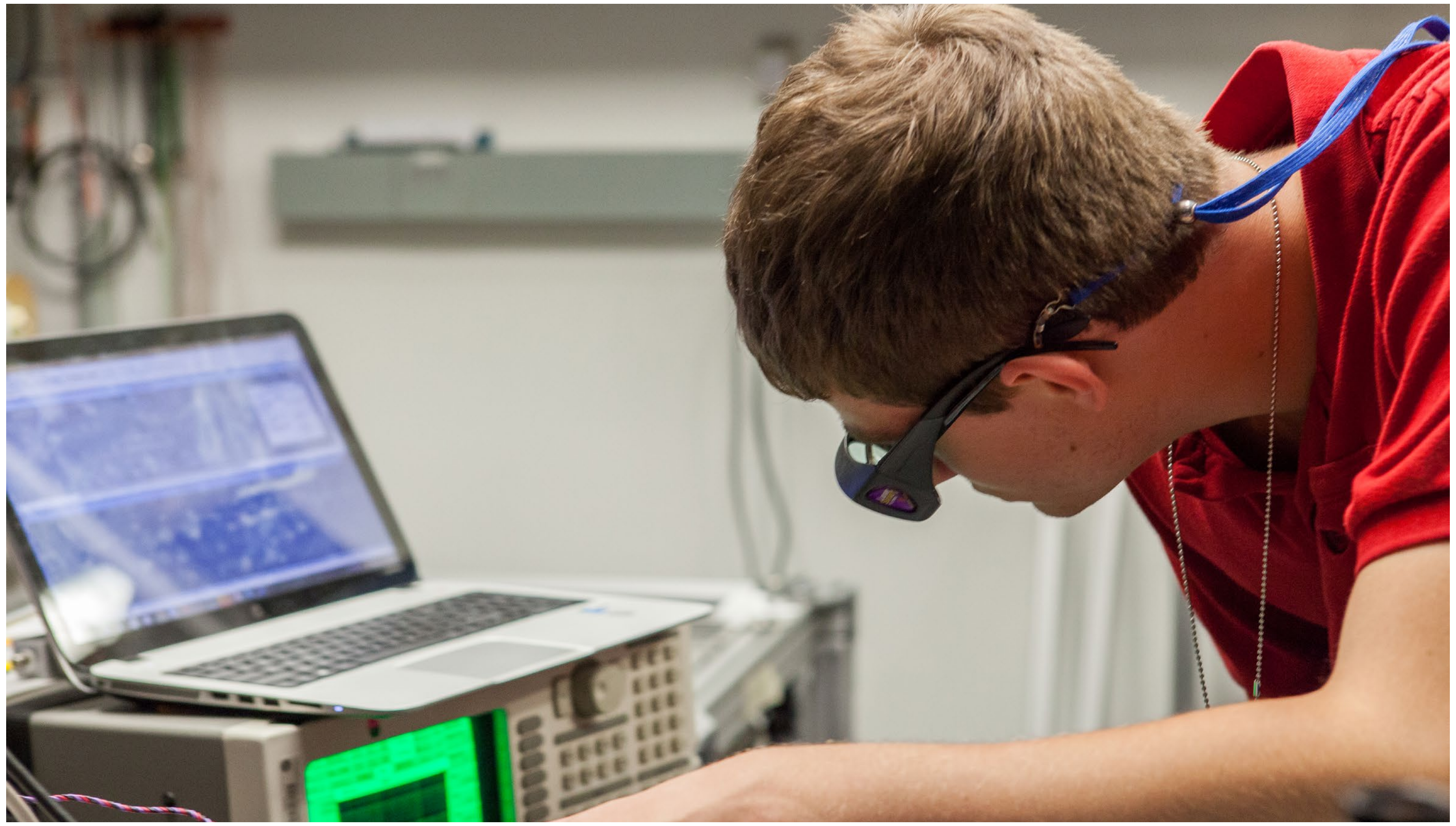
Through experimentation, the team used state-of-the-art fabrication technology to fully insulate the tiny space between the electrodes to eliminate potential electrical crosstalk. It also applied a very thin coating to prevent the shutters from sticking when opened—a significant improvement. According to Li, a 3,000-cycle laboratory test indicated that a third of the shutters stuck. After coating them, the team ran a 27,000-cycle test and not a single shutter adhered to the sides, Li said.

As a result of the progress, Li said three astrophysicists now are interested in applying the technology to their own mission concepts. In fact, one of those scientists is so committed to advancing the microshutter array that he plans to demonstrate it during a sounding-rocket mission next year, Li said.

Although spectroscopy—the study of the absorption and emission of light by matter—obviously benefits from the advanced technology, Li said it also applies to lidar instruments. These devices measure distance by illuminating a target with a laser and analyzing the reflected light.

"In just four years, we have made great progress. A major private company has expressed interest in our technology, to say nothing of the three potential astrophysics missions," Li said. "Given our progress, I am confident that we can make this technology more readily accessible to the optics community." ■

Above: Goddard engineer Lance Oh is one of several technologists developing a next-generation microshutter array technology originally developed for the James Webb Space Telescope. Photo credit: NASA/Goddard/Bill Hrybyk



MEASURING GRAVITATIONAL WAVES WITH ELISA

By: Max Gleber

Puffs of smoke waft from a circuit board as interns solder tiny circuits for the Evolved Laser Interferometer Space Antenna.

"We're looking for evidence of black holes," Robert Buttles said. "As of now we only have images of material spinning around a black hole, but we haven't been able to physically measure the black hole itself."

Pairs of black holes radiate gravitational waves as they orbit each other in a binary system. Analyzing these waves can allow scientists to study black holes directly.

"All other emission from a black hole binary is actually from material around the black hole—for example, gas falling into the black hole from an accretion disk and generating x-rays—but not [data] from the black hole itself," said Jeffery Livas, an astrophysicist working on the eLISA.

Ripples occur when a stone falls into the water. The same applies with gravity when a black hole binary disturbs nearby regions of spacetime. These gravitational ripples cause the cosmos to oscillate imperceptibly, stretching even our bodies here on Earth by trillionths of meters.

The eLISA mission aims to identify, locate, and study the sources of these waves to learn about the formation of large-scale structure in the universe and test general relativity with precise observations. This observatory consists of three satellites, each housing two metallic test masses that magnetism, radiation, and interplanetary fields cannot rattle.

"You want the masses to be shielded from everything except for gravity," Livas said. "We don't know how to shield from gravity. And these masses floating in space have no net force on them. We then range the distance between them with a laser beam. And if we see a pattern where the distance changes, where the shape stretches in one direction and scrunches in another, we mark that oscillation as a gravitational wave."

Gravitational waves require incredibly dense masses moving at extremely high speeds to form. Binary star systems, galaxies colliding, and other forces scientists have yet to discover could also generate gravitational waves.

"We expect there will be sources we don't know anything about or have not yet imagined," Livas said. ■

Above: NASA Goddard intern Robert Buttles adjusts equipment used for the eLISA mission, which will test for vibrations that could reveal subtle changes in gravity. Photo credit: NASA/Goddard/Kristen Basham

NASA POSTDOCTORAL FELLOW SELECTED FOR AGU AWARD

By: Max Gleber

NASA postdoctoral fellow Rebekah Evans will receive the Basu United States Early Career Award for Research Excellence in Sun-Earth Systems Sciences at the 2014 Fall Meeting of the American Geophysical Union in San Francisco, California. The AGU has recognized her outstanding contributions to solar physics through her work with numerical modeling.

Evans uses numerical models to study the properties of gigantic eruptions from the sun known as coronal mass ejections, or CMEs. Using these mathematical approximations, Evans's work has led to a greater understanding of processes throughout the sun's surface and atmosphere: How does the constant stream of particles from the sun called the solar wind evolve? Why does the sun's atmosphere reach temperatures exceeding that of the sun itself? How do CMEs—which are made of immense clouds of magnetized particles governed by laws of physics rarely experienced in our day to day lives—move?

"Even though we can see a coronal mass ejection in coronagraph images, we can't see the three dimensional structure—which direction it's going, how fast it's going, how big it is," Evans said.

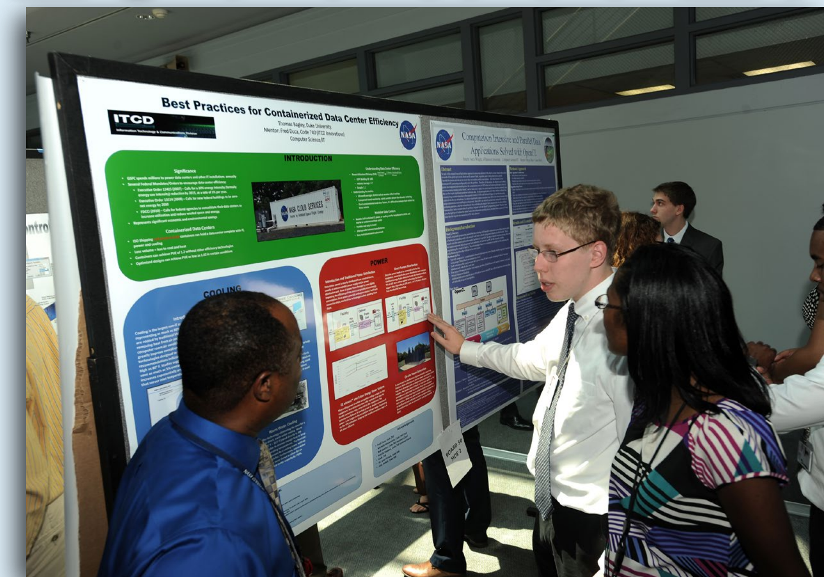
Inspired by her mentor Masha Kuznetsova at NASA's Goddard Space Flight Center in Greenbelt, Maryland, Evans joined the Community Coordinated Modeling Center nearly three years ago as part of the NASA Postdoctoral Program.

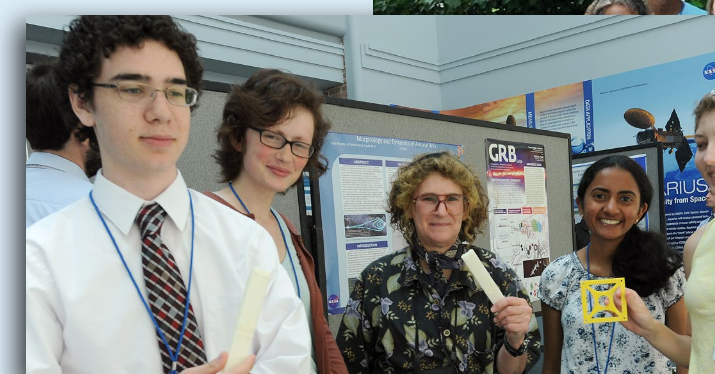
Since joining NASA, Evans has developed new models that predict the trajectory of solar energetic particles. The shockwave from coronal mass ejections can accelerate such particles to 90 percent the speed of light. Magnetic elements of the CME then alter near-Earth space as they course through our planet's environment, sometimes disrupting satellite electronics and affecting our power grid systems.

"There are so many talented people doing research, developing missions and taking amazing data here," Evans said. "Being here with the scientists is one of the reasons I've been able to do such cool and interesting research, so I'm really grateful for the opportunity to participate in this (postdoctoral) program. Compared to terrestrial weather, we're a very young science. Coming in as a young person, I am very excited to find out what we're going to know thirty years from now, both through modeling and the observational data." ■

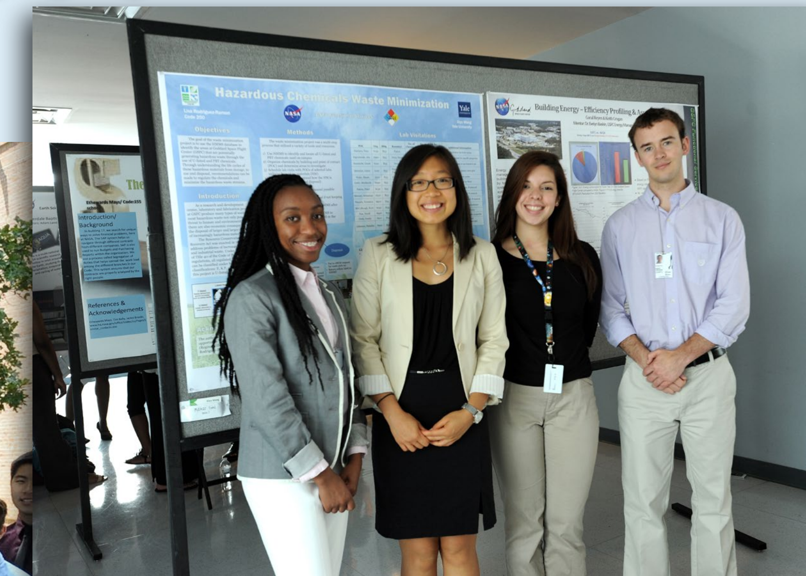
Below: NASA postdoctoral fellow Rebekah Evans standing next to two of the Community Coordinated Modeling Center's monitors at NASA's Goddard Space Flight Center in Greenbelt, Maryland. Researchers at Goddard study solar activity captured by NASA spacecraft to help improve their understanding of solar flares and other phenomena. Photo credit: NASA/Goddard/Debora McCallum

2014 INTERN POSTER SESSION





By: Max Gleber and Izumi Hansen



Hundreds of interns gathered in the Building 28 atrium at NASA's Goddard Space Flight Center to present findings of their summer projects in the form of posters.

"I think presenting is the most exciting part of the research, because you're able to share what nobody has ever seen before," said Jamar Liburd, a junior at the University of the Virgin Islands.

Liburd monitored x-ray activity from the binary star system Eta Carinae and observed the brightest flux it has exhibited in more than 18 years. Other posters featured projects that range from testing the thermal durability of spacecraft to programming models of neutron star activity.

"I enjoyed the challenge of figuring out how to describe something that's not a visual thing," said Jennifer Woodman, a graduate student at the Portland State University. Woodman wrote science articles for Earthzine. Instead of demonstrating a scientific project, she described her writing process. "I've written essays on hope and space exploration, about nanosatellites and fish spawning. There's not a lot of commonality in the stories, so I thought I could show how we break down stories isn't all that different from the scientific method."

Satellite Servicing and Capabilities Office interns used robotic arms to accompany their poster. Passersby could use Xbox controllers to command these robotic arms to manipulate wooden balls and blocks on the table.

"The kids have an easy time piloting these," said Aaron Neely, an SSCO intern. His team started with a cheap set of robotic arms and updated them to include Xbox controllers. This allows greater accessibility during NASA outreach programs. "The Xbox controller is more intuitive, especially for kids to use, because they've probably already used these."

Judges circulated throughout Building 28's atrium to critique the posters. The experience was the first opportunity for many to present a scientific poster, an important skill for most science careers. ■

Photo credit: NASA/Goddard/Bill Hrybyk and Debora McCallum

OUTSIDE GODDARD

By: Elizabeth M. Jarrell

Drawn into the Sky

For as long as she can remember, Goddard astrophysicist Amber Straughn has always been drawn to anything in the sky. Straughn is the deputy project scientist for James Webb Space Telescope Science Communications.

Straughn recently fulfilled a lifelong dream to earn her private pilot's license. Her enthusiasm was contagious. Her husband Matt trained with her and also became a private pilot.

"He is very practical about flying and wants to get somewhere. I do it mostly because it's fun. I could just fly around in circles and be happy. We're a good team," said Straughn.

Obtaining a private pilot's license involves both ground school and flight lessons. The ground school provides the fundamental knowledge base and prepares the student to pass the Federal Aviation Administration's written knowledge exam. In the Washington, D.C. area, special training and additional tests are also required due to the complicated and restricted airspace in the area.

Concurrent with their written studies, they both began flight lessons. The single most important item to any pilot is their logbook. Pilots are required to log all flight time in a logbook. Instructors and examiners approve certain flights and note passage of examinations by signing the logbook. After logging about 20 hours of flight time with her instructor, he signed off in her log book that she was ready for her first solo flight.

"It was amazing. I did three takeoffs and landings by myself. It was so much fun, but also a little bit nerve-wracking when I realized after I took off that first time that I then had to land the plane by myself" said Straughn.

The next big step, which she immediately started, was learning how to navigate, culminating in flying cross-country more than 50 nautical miles (about the same in statute miles).

"Initially, we navigate using charts, which we compare with visual references on the ground like a road or water," said Straughn. "Later, we learn to navigate by basic instruments using radio aides."

Straughn flew her first solo cross-country to Salisbury, Maryland and back. In January 2013, she flew a second solo cross-country, stopping in Salisbury, Maryland; Ocean City, Maryland; Easton, Maryland and returning to Bowie.

Finally came the check ride, which included an oral exam and a flight test on the same day. On March 5, 2013, at Easton Airport in Easton, Maryland, the FAA flight examiner conducted the oral exam, which consisted of 4–5 hours of questioning.

"Once the oral exam was over, he asked me if I was ready to fly," said Straughn. "I said I was very ready to fly." The flight examination consisted of several different specific types of takeoffs and landings, flight maneuvers, stalls and a demonstration that she could safely execute an emergency landing.

He then stamped and signed her logbook stating that she was a private pilot and gave her a temporary certificate to be kept in her logbook. The FAA later mailed the actual license.

"I couldn't believe I had actually done this after wanting to do it so long," said Straughn. Her husband, who was waiting for her back at their home airport, passed the next week.

The next month, the couple bought "Lulu," a 1977 Cessna 182, four-seater, single engine aircraft considered high-performance because of its more powerful, higher horsepower engine and controllable-pitch propeller. They needed an endorsement by a flight instructor before flying the high-performance airplane. After flying with an instructor for a few hours, both received endorsements in their log books.

"Lulu is older than me, but she flies great!" said Straughn. "We try to fly a minimum of once every two weeks just to keep our skills up," said Straughn. "We go on fun, little trips to Cambridge, Maryland, for breakfast on Saturdays a lot."

"For me, learning to fly is an extension of my love for astronomy, for all things in the sky," said Straughn. ■

Center: Straughn and Lulu. Photo credit: NASA/Goddard/Chris Gunn